

ABSTRACT

A method for gasifying carbonaceous materials to fuel gases comprises the formation of an ultra-superheated steam (USS) composition substantially containing water vapor, carbon dioxide and highly reactive free radicals thereof, at a temperature of about 2400°F (1316°C) to about 5000°F (2760°C). Rapid gasification of a carbonaceous material with USS is indicated by the production of USS in a clear, colorless flame, and its enthalpy obviates the need for super-stoichiometric steam input. In a related aspect of the invention, gasification output per pound of steam as well as CO and H₂ concentrations are increased by adding a relatively small amount of an oxygen-containing material such as cellulose to the input elemental carbon material, or by adding a relatively small amount of elemental carbon material such as coal to an input oxygen-containing material such as cellulose. Methods for controlling a gasifier system to enhance gasification efficiency are described.